REMARKS

The Official Action dated July 15, 2004, has been carefully considered. Applicant appreciates the Examiner's thorough review of the application. Consideration of the changes and remarks presented herein and reconsideration of the objections and rejections are respectfully requested.

By the present amendment, claims 1, 11, 26, 30, 35, 39-46 and 48 have been amended. Support for the amendments can be found in the specification, claims and drawings as originally filed. Accordingly, claims 1-48 stand pending in this application. As set forth below, it is believed that claims 1-48 are in condition for allowance. It is believed that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

Applicant is appreciative of the indication in the Office Action that claims 11 and 30 would be allowable if rewritten in independent form. Claims 11 and 30 have been rewritten in independent form in accordance with that indication.

In the Official Action, the Examiner also indicates that new corrected drawings are required due to the informal nature of the current drawings. In light of this objection to the drawings, formal drawings have been provided along with this response. Applicant believes that these drawings meet the formal requirements and that they do not involve any introduction of new matter, and as such, Applicant believes entry is in order and is respectfully requested.

In the Official Action, the Examiner rejects claim 35 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In light of the amendment made to claim 35, Applicant believes this rejection has been overcome and respectfully requests

reconsideration.

In the Official Action, the Examiner rejects claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 under 35 U.S.C. § 102(b) as being anticipated by Fang et al (U.S. Patent No. 5,771,318). Applicant respectfully traverses this rejection for the reasons stated more fully below.

As will be set forth in detail below, it is submitted that the methods for enhancing a digital image defined by claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 are not anticipated by and are patentably distinguishable from Fang et al. Accordingly, this rejection is traversed and reconsideration is respectfully requested.

The methods for enhancing a digital image as defined by claim 1, on which claims 2-15 depend, include providing a digital original image comprising a plurality of pixels, wherein each pixel includes an original value corresponding to a characteristic of the image, calculating a dynamic image mask value for each pixel by averaging the original value of a pixel with the original values of the pixels proximate that pixel having original values lower than a threshold sharpness, and applying the dynamic image mask value to the original value for each corresponding pixel using a mathematical function to produce an enhanced image.

The software tangibly embodied in a computer readable medium and operable to produce an enhanced image by implementing a method as defined by claim 26, from which claims 27-38 depend, includes generating a dynamic image mask from a digital original image, the dynamic image mask and the original image each having a plurality of pixels having varying values, wherein the values of the plurality of dynamic image mask pixels are set to form sharper edges corresponding to areas of more rapidly changing pixel values in the original image and less sharp regions corresponding to areas of less rapidly changing pixel values in the original image and combining the dynamic image mask with the original image to produce the enhanced image.

In contrast, Fang et al disclose an adaptive edge-preserving smoothing filter to effectively reduce noise levels while preserving fine structures in data (col. 3, lines 11-12). Fang et al teach a an adaptive edge-preserving filter developed as a smoothness constraint from an iterative PET image reconstruction scheme (col. 3, lines 46-50). Particularly, the methods disclosed in Fang et al are directed toward x-ray and Angiography images (col. 7, line 2).

Rejection for anticipation or lack of novelty requires, as the first step in the query, that all elements of the claimed invention be described in single reference. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989), *cert. denied*, 493 U.S.P.Q.853 (1989). Applicant is unable to find any teaching or disclosure by Fang et al of methods as defined by the present claims. To anticipate, every element and limitations of the claimed invention must be found in a single prior art reference, arranged as in the claim. *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383, 58 U.S.P.Q.2d 1286, 1291 (Fed. Cir. 2001); *Scripps Clinic & Research Foundation v. Genentech, Inc.*, 927 F.2d 1565, 1576, 18 U.S.P.Q.2d 1001, 1010 (Fed. Cir. 1991). With regard to claim 1, Applicant finds no teaching or disclosure in Fang et al of averaging the original value of a pixel with the original values of the pixels proximate that pixel having original values lower than a threshold sharpness. The Examiner contends that the example of "$\alpha = \infty$" indicates a sharpness threshold, however, Fang et al do not teach any such threshold. Specifically, the α represents a control parameter for defining the filter and not sharpness. Moreover, α does not relate to or allow one to derive a sharpness threshold. Moreover, even if this were a sharpness threshold, Fang et al do not teach claimed threshold sharpness because Fang et al do not disclose the relationship of the pixels themselves, where the particular pixels proximate to the original pixel are evaluated under the sharpness threshold. With respect to claim 26, Fang et

al do not teach that the dynamic image mask pixels are set to form sharper edges corresponding to areas of more rapidly changing pixel values in the original image and less sharp regions corresponding to areas of less rapidly changing pixel values in the original image. Fang et al fail to teach a dynamic image mask which is set up to form both sharper and less sharper edges in regards to the pixel values. The teachings in Fang et al are directed to only sharpening and preserving such edges. Moreover, Fang et al do not disclose that areas of sharpness are based upon rapidly changing pixel values, in contrast to claim 26. As such, Fang et al fail to teach or disclose the presently claimed inventive methods. In view of the deficiencies of Fang et al to teach the methods as set forth in claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37, the presently claimed invention is not taught or disclosed by Fang et al.

It is therefore submitted that the methods as defined by claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 are not anticipated by and are patentably distinguishable from Fang et al and the rejection of claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 under 35 U.S.C. § 102 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 2-6, 8, 13, 16-20 and 23-25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al as applied to claim 1 above, and further in view of Fujimoto et al (U.S. Patent No. 5,771,107). The Examiner incorporates his arguments from above regarding Fang et al. The Examiner notes that Fang et al fail to expressly disclose a method for capturing the image data. The Examiner contends however, that Fujimoto et al disclose a scanner for reading images, and as such held that it would have been obvious to one reasonably skilled in the art to modify the enhancement system disclosed in Fang et al by adding an image sensor for acquiring images as taught by Fujimoto et al.

The Examiner also alleges that Fujimoto et al teach capturing color imaging data due to the disclosure of a scanner. The Examiner also asserts that Fujimoto et al disclose

detecting edges using black image data, which is different form the original color values used in averaging. Moreover, the Examiner contends that this disclosure provides support that grayscale contrast and the image contrast are not the same thing and can be independently controlled.

As will be set forth in detail below, it is submitted that the methods and systems of claims 2-6, 8, 13, 16-20 and 23-25 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Fujimoto et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Claims 2-6, 8 and 13 depend from claim 1 which has been presented above along with the arguments as to why claim 1 is patentably distinct from the teachings of Fang et al. As defined by claim 16, from which claims 17-20 and 23-25 depend, the present invention is directed towards a system including a sensor system operably to produce electronic signals corresponding to certain characteristics of a subject, a processor operable to receive the electronic signals and produce image values for each pixel, and a memory media having software stored thereon, wherein the software is operable to calculate a dynamic image mask value for each pixel by averaging the image value of a pixel with the image values of the pixels proximate that pixel having image values lower than a threshold sharpness and apply the dynamic image mask value to the image value for each corresponding pixel using a mathematical function to produce an enhanced image.

Fujimoto et al disclose an image processor which processes an image to be copied with attention to the detection of black edges so that clear color copy outputs are obtained (abstract). Moreover, R, G and B data read out from an original by a scanner are converted into C, M and Y complementary color data by a complementary color reversing circuit (abstract). The complementary color data are transmitted to a black edge processing circuit

and to a black edge detecting circuit (abstract). The black edge detecting circuit detects the inside or the outside of a black edge, and accordingly, the black edge processing circuit changes the coefficient of a spatial filter (abstract). The output of the black edge processing circuit is outputted to a printer through a black generating circuit, a tone correcting circuit and a half tone processing circuit (abstract).

In order for references to be relied upon to support a rejection under 35 U.S.C. § 103 they must provide an enabling disclosure, i.e., they must place the claimed invention in the possession of the public. *Glaxo Inc. v. Novopharm Ltd.*, 34 U.S.P.Q.2d, 1565 (Fed. Cir. 1995); *In re Payne*, 203 U.S.P.Q. 245 (CCPA 1979). Applicant finds no teaching or suggestion by Fang et al alone or in combination with Fujimoto et al of a system as set forth by claim 16. As defined by the claims of the present invention, the system includes software which averages the original value of a pixel with the original values of the pixels proximate that pixel having original values lower than a threshold sharpness when calculating a dynamic image mask value. As previously asserted, Fang et al fail to teach any such threshold sharpness, or the relationship of the threshold sharpness to the original pixel and the those pixels proximate to the original pixel. Applicant found no teaching or suggestion in Fujimoto et al to make up for the deficiency of Fang et al, and Fujimoto et al have not been cited in the Office Action for such purpose. As such, Fang et al alone or in the argued combination with Fujimoto et al fail to teach the presently claimed methods and systems.

It is therefore submitted, that the presently claimed methods and systems for enhancing digital images as defined by claims 2-6, 8, 13, 16-20 and 23-25 are non-obvious over and patentably distinguishable from Fang et al in view of Fujimoto et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 39-44 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al as applied to claim 26 above, and further in view of Fujimoto et al. The Examiner asserts similar arguments, but also suggests that Fujimoto et al disclose a color decoder operably connected to the image sensor to generate color image data. Moreover, the Examiner contends that the complementary color reversing circuit disclosed in Fujimoto et al is analogous to the claimed color management system.

However, as will be set forth in detail below, it is submitted that the systems of claims 39-44 are non-obvious and patentably distinguishable from the teachings of Fang et al as applied to claim 26 and in further view of Fujimoto et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Claim 39, from which claims 40-48 depend, includes a system having an image sensor to convert light reflected from an image into information representative of the image, a processor, memory operably coupled to the processor, and a program of instructions capable of being stored in the memory and executed by the processor, the program of instructions to manipulate the processor to: obtain a dynamic image mask, the dynamic image mask and the information representative of the image each including a plurality of pixels having varying values, wherein the values of the plurality of dynamic image mask pixels are set to form sharper edges corresponding to areas of more rapidly changing pixel values in the original image and less sharp regions corresponding to areas of less rapidly changing pixel values in the original image; and combine the image mask with the information representative of the image to obtain a masked image.

As previously asserted, Fang et al fail to teach that the dynamic image mask pixels are set to form sharper edges corresponding to areas of more rapidly changing pixel values in the original image and less sharp regions corresponding to areas of less rapidly changing pixel

values in the original image. Fang et al fail to teach a dynamic image mask which is set up to form both sharper and less sharper edges in regards to the pixel values. The teachings in Fang et al are directed to only sharpening and preserving such edges. Moreover, Fang et al do not disclose that areas of sharpness are based upon rapidly changing pixel values. Applicant found no teaching or suggestion in Fujimoto et al to make up for the deficiency of Fang et al, and Fujimoto et al have not been cited in the Office Action for such purpose. As such, Fang et al alone or in the argued combination with Fujimoto et al fail to teach the presently claimed systems.

It is therefore submitted, that the presently claimed systems as defined by claims 39-44 are non-obvious over and patentably distinguishable from Fang et al as applied to claim 26 above, and further in view of Fujimoto et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 21, 22 and 45-48 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Fang et al and Fujimoto et al as applied to claims 16, 39 and 42 above, and further in view of Tretter et al (U.S. Patent No. 5,867,606). The Examiner notes that the combination fails to expressly disclose a memory for storing the color information. However, the Examiner contends that Tretter et al disclose such a memory and that it would have been obvious to modify the color image processing system disclosed in the combination of Fang et al and Fujimoto et al by adding a memory for storing the color image data as disclosed by Tretter et al. Moreover, the Examiner notes that the combination also fails to disclose a digital camera or a video camera for capturing image data, but asserts that Tretter et al do. Finally, the Examiner notes that Fujimoto et al fail to disclose a display for displaying the color information, but asserts that the Tretter et al reference discloses such a display.

Tretter et al disclose an apparatus and method for determining the appropriate amount of sharpening for an image (col. 1, lines 7-10). Particularly, the system sharpens or enhances an original image (e.g., a digital image) (col. 1, lines 14-16).

Once again, Fang et al fail to teach a dynamic image mask which is set up to form both sharper and less sharper edges in regards to the pixel values. The teachings in Fang et al are directed to only sharpening and preserving such edges. As such, Fang et al fail to teach or disclose the presently claimed inventive methods and systems. Fujimoto et al has only been asserted in the Office Action for showing a scanner and Tretter for disclosing a digital camera, and Applicant found not teaching or suggestion in these references that makes up for the deficiencies of Fang et al.

It is therefore submitted, that the presently claimed methods and systems for enhancing digital images as defined by claims 21, 22 and 45-48 are non-obvious over and patentably distinguishable from combination of Fang et al and Fujimoto et al as applied to claims 16, 39 and 42 above, and further in view of Tretter et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 7 and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Qian (U.S. Patent No. 6,707,940). The Examiner notes that Fang et al fail to expressly disclose the claimed formula for determining weighted original values. However, the Examiner asserts that Qian discloses using the claimed formula to calculate "smoothing factors" and contends that these smoothing factors are analogous to the weighted original values.

However, as will be set forth in detail below, it is submitted that the methods of claims 7 and 34 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Qian. Accordingly this rejection is traversed and reconsideration is

respectfully requested.

Qian discloses a method and apparatus that smoothes images within regions but not across boundaries (abstract). Moreover, the Qian disclosure is directed towards image process, particularly, image segmentation (col. 1, lines 7-8).

Claim 7, depending from claim 1, and claim 34, depending from claim 26 both include a limitation setting forth a particular mathematic formula for determining weighted original values. As previously asserted the claims 1 and 26 are not taught by Fang et al. Applicant found no teaching or suggestion in Qian to make up for the deficiency of Fang et al, and Qian has not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods for enhancing digital images as defined by claims 7 and 34 are non-obvious over and patentably distinguishable from combination of Fang et al in view of Qian whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 12 and 31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Paik (U.S. Patent No. 6,370,279). The Examiner notes that Fang et al fail to teach a histogram leveling. However, the Examiner asserts that the histogram equalization disclosed in Paik is analogous to the histogram leveling.

However, as will be set forth in detail below, it is submitted that the methods of claims 12 and 31 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Paik. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Paik discloses an image processing system (col. 1, lines 6-7). More particularly, Paik describes a block-based image processing method capable of removing blocking artifacts,

caused by another block-based image process, by using spatial adaptive filtering based on an image restoration theory (col. 2, lines 50-54). In addition, Paik teaches a block-based image processing apparatus for the method (col. 2, lines 55-57).

Claim 12, depending from claim 1, and claim 31, depending from claim 26 both include a limitation including histogram leveling. As previously asserted, claims 1 and 26 are not taught by Fang et al. Applicant found no teaching or suggestion in Paik to make up for the deficiency of Fang et al, and Paik has not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods as defined by claims 12 and 31 are non-obvious over and patentably distinguishable from combination of Fang et al in view of Paik whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 9 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Wober et al (U.S. Patent No. 5,729,631). The Examiner notes that Fang et al fail to disclose the generation of the dynamic image mask which includes performing a pyramidal decomposition on the original image. However, the Examiner contends that Wober et al disclose performing a pyramidal decomposition on the original image in the generation of an image mask.

However, as will be set forth in detail below, it is submitted that the methods of claims 9 and 36 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Wober et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Wober et al disclose improved methods and apparatus for image processing, particularly to processes and systems for removing noise from an image by using discrete

cosine transforms in a multi-level pyramid image representation (col. 1, lines 20-24). Moreover, Wober et al teach noise modeling and filtering systems for reducing both additive and signal dependent noise from a noisy image signal (co. 3, lines 21-23). More specifically, Wober et al disclose removing noise from an image by first noise modeling an image signal source to generate noise masks and lookup table value characteristic of noise at different frequency levels for each channel, and then applying the stored noise masks and lookup table values to an image signal for noise removal (abstract).

Claim 9, depending from claim 1, and claim 36, depending from claim 26 both include a limitation including histogram leveling. As previously asserted the claims 1 and 26 are not taught by Fang et al. Applicant found no teaching or suggestion in Wober et al to make up for the deficiency of Fang et al, and Wober et al have not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods for enhancing digital images as defined by claims 9 and 36 are non-obvious over and patentably distinguishable from combination of Fang et al in view of Wober et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

Finally, in the Official Action, claim 38 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Hu et al (U.S. Patent No. 6,668,097). The Examiner notes that Fang et al fail to disclose software operable to perform the steps of the disclosed method is stored on a digital camera. However, the Examiner contends that Hu et al disclose a similar image processing method which is operable to be executed on a digital camera.

However, as will be set forth in detail below, it is submitted that the methods of claim 38 is non-obvious and patentably distinguishable from the teachings of Fang et al in further

view of Hu et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Hu et al disclose an image processing system receiving a decompressed image and having an edge detector identifying edges between contrasting regions of pixels or the image (col. 2, lines 10-13). More particularly, Hu et al disclose an apparatus for post-processing of decompressed images having ringing artifacts which identify edges of the image and defines zones outside of those edges but conforming thereto in which ringing artifacts are to be expected (abstract).

Claim 38, depending from claim 26, includes a limitation of having the software resident on a digital camera. As previously asserted the claim 26 is not taught by Fang et al. Applicant found no teaching or suggestion in Hu et al to make up for the deficiency of Fang et al, and Hu et al have not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods as defined by claim 38 is non-obvious over and patentably distinguishable from combination of Fang et al in view of Hu et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

It is believed that the above represents a complete response to the Examiner's objections and rejections under 35 U.S.C. §§102, 103 and 112, second paragraph, and places the present application in condition for allowance. Reconsideration and an early allowance are respectfully requested.

Respectfully submitted,

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